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| Name(s) of Risk Team Members: A. Etkin, Y. Makdisi | | | Point Value → Parameter ↓ | 1 | 2 | 3 | 4 | 5 | | | | | |
| Area/Facility Description Title: Collider-Accelerator Area/Facility # (if applicable): Area-Wide FRA 13-06 | | | Occupancy or Use | ≤once/year | ≤once/month | ≤once/week | ≤once/shift | >once/shift | | | | | |
| Area/Facility Description: PHENIX Area-Wide | | | Severity | First Aid Only | Medical Treatment | Lost Time | Partial Disability | Death or Permanent Disability | | | | | |
| | | | Likelihood | Extremely Unlikely | Unlikely | Possible | Probable | Multiple | | | | | |
| Approved by: <i>E. Lessard</i> Date: 5-24-2006 Rev.#: 0 | | | | | | | | | | | | | |
| Reason for Revision (if applicable): | | | | | | Comments: | | | | | | | |
| | | | Before Additional Controls | | | | | | After Additional Controls | | | | |
| Physical Item or Activity | Hazard(s) | Control(s) | Occupancy A | Severity B | Likelihood C | Risk* AxBxC | Control(s) Added to Reduce Risk | | Occupancy A | Severity B | Likelihood C | Risk* AxBxC | % Risk Reduction |
| Primary Beam | High hazard ionizing radiation | ACS; PASS; postings; crash buttons and chords; C-AD area classification; shielding; dosimeter; training; RSC reviews | 1 | 5 | 2 | 10 | | | | | | | |
| General Area Radiation, Residual Radiation, External Radiation | Ionizing radiation | Postings, PASS, training, shielding, RCD surveys, RCD oversight, RWP, work planning | 4 | 1 | 2 | 8 | | | | | | | |
| Hydraulics | Being struck by an object due to a pressure release | Design reviews, ESRC/ASSRC reviews, pressure testing, LOTO, work planning, PPE, training, procedures, posting labeling | 3 | 4 | 2 | 24 | | | | | | | |
| Hydraulics | Falls/Slips on same level | Design reviews, ESRC/ASSRC reviews, pressure testing, LOTO, work planning, Tier 1 inspections | 3 | 4 | 3 | 36 | | | | | | | |
| Hydraulics | Fire | Design reviews, ESRC/ASSRC reviews, proof testing, LOTO, work planning, PPE, training, Fire/Rescue Group response | 3 | 4 | 2 | 24 | | | | | | | |
| Electrical Equipment & Power Supplies BNL Class A & B <250 V AC; <1000 V DC | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 5 | 3 | 2 | 30 | See Further Description below | | | | | | |

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| Electrical Equipment & Power Supplies BNL Class C <600 V AC; <6000 V DC | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; working on or near energized conductors permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures; two-person rule for energized electrical work. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 3 | 4 | 2 | 24 | | | | | |
| Electrical Equipment & Power Supplies BNL Class C <600 V AC; <6000 V DC | Arc blast; burn | Procedures, training, PPE. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Electrical Disconnects And Switches | Arc blast; burn | Procedures, training, PPE. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Electrical Disconnects And Switches | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; GFCI; grounding standards; emergency procedures; two-person rule for energized electrical work. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Motor Control Centers; Panels And Wall Sockets | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 4 | 4 | 2 | 32 | | | | | |

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| Motor Control Centers; Panels And Wall Sockets | Arc blast; burn | PPE; training; procedures. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 4 | 4 | 2 | 32 | | | | | |
| Electrical Powered Hand Tools | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; procedures; training; labeling; work planning; GFCI; grounding standards; double insulation. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 4 | 3 | 2 | 24 | | | | | |
| Extension Chords; Temporary Wiring And Power Strips | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; qualified electricians and technicians; GFCI; grounding standards. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA's NRTL requirements began June 1, 2005. | 4 | 3 | 2 | 24 | | | | | |
| Vacuum | Ear damage | Postings; PPE; maintenance; training; work planning; ASSRC reviews; procedures; Tier 1 inspections; Chief ME reviews; vacuum windows covered during handling; use of industry standards; design reviews | 3 | 4 | 2 | 24 | | | | | |
| Vacuum | Being struck by an object such as flying debris | Postings; PPE; maintenance; training; work planning; ASSRC reviews; procedures; Tier 1 inspections; Chief ME reviews; vacuum windows covered during handling; ; use of industry standards; design reviews | 3 | 4 | 2 | 24 | | | | | |
| Magnetic Field | Being struck by an object due to adverse mechanical force exerted on ferromagnetic objects and or to electronic/medical implants | Barriers; warning systems; postings; training; ESRC review; work planning; procedures; Tier 1 inspections; magnetic safety reviews; medical exams | 1 | 4 | 2 | 8 | | | | | |
| Flammable /Explosive Gases | Fire, smoke and heat | Fire detection & suppression systems; procedures; training; equipment protective systems; ASSRC/ESRC reviews; Fire Hazards Analysis; Tier 1 inspections; maintenance; emergency procedures; BNL Fire Rescue; ASE requirements; volume controls; segregation controls; labeling; area posting; gas detection interlock systems; warning alarm/yellow strobe | 4 | 4 | 2 | 32 | | | | | |
| Gasses | Oxygen deficiency | ODH analyses; ODH controls; training; remote/local audible/visible alarms; emergency response; work planning; MSDS; LOTO; postings; flammable gas alarms; cylinder storage controls; cylinder labels; gas volume limits; inspections; cylinder hydrostatic testing | 4 | 5 | 2 | 40 | | | | | |

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| Lighting | Being struck against an object, such as a carpenter walking into a door frame, due to poor visibility | Tier 1 inspections; maintenance; emergency lighting; temporary lighting | 3 | 2 | 3 | 18 | | | | | |
| Lighting | Falls on same level | Tier 1 inspections; maintenance; emergency lighting; temporary lighting | 3 | 3 | 3 | 27 | | | | | |
| Lighting | Being struck by an object due to a material handling mishap | Tier 1 inspections; maintenance; emergency lighting; temporary lighting | 2 | 3 | 3 | 18 | | | | | |
| Material Handling Equipment | Falls to lower level, such as falling from a ladder or over a railing | Training, work planning, inspections, independent PE inspections and approval of equipment, fall protection training, approved scaffolding and platforms, approved fall protection harnesses, Tier 1 inspections, PPE, PE maintenance | 3 | 4 | 3 | 36 | | | | | |
| Material Handling Equipment | Becoming caught in or compressed by equipment | Training, work planning, inspections, Tier 1 inspections, PPE | 3 | 4 | 3 | 36 | | | | | |
| Material Handling | Being struck by an object due to improperly secured material; loss of control | Work planning; equipment specific training; work area barricades and controls; PPE; clamps; straps; vices; fixtures | 3 | 3 | 3 | 27 | | | | | |
| Chemical Handling | Eye exposure | Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections | 3 | 4 | 2 | 24 | | | | | |
| Chemicals | Inhalation exposure | Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections | 3 | 3 | 2 | 18 | | | | | |
| Chemicals | Fire; explosions | Procedures; compliance with regulations; training; CMS inventory; MSDS; volume controls; PPE as required; locked or controlled areas; postings; labeling; proper containers; segregation; proper spill cleanup equipment available; Tier 1 inspections | 3 | 2 | 2 | 12 | | | | | |
| Manual Material Handling | Overexertion – injuries caused by excessive lifting, pushing, pulling, holding, carrying or throwing of an object | Gloves; hardhat; handcarts; dollies; training; safety shoes | 4 | 3 | 3 | 36 | | | | | |
| Remotely Operated Equipment | Becoming caught in or compressed by equipment | Postings; barriers; guards; maintenance; training; work planning; procedures; Tier 1 inspections; ASSRC reviews | 2 | 4 | 2 | 16 | | | | | |
| Use Of Hand Tools | Being struck by an object, such as flying chips | PPE; training; maintenance; Tier 1 inspections; UL listed equipment; pre-inspections | 4 | 2 | 3 | 24 | | | | | |
| Use Of Hand Tools | Being struck against an object, such as sharp surfaces | PPE; training; guarding | 4 | 2 | 3 | 24 | | | | | |
| Use Of Hand Tools | Becoming caught in or compressed by equipment | Equipment specific training; guarding; PPE; postings | 4 | 2 | 3 | 24 | | | | | |
| Machining Materials | Becoming caught in or compressed by equipment | Equipment specific training; authorized users; machine guards; PPE; postings; maintenance; Tier 1 inspections | 2 | 3 | 3 | 18 | | | | | |

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| Machining Materials | Being struck by an object, such as flying chips | Equipment specific training; authorized users; machine guards; PPE; postings; maintenance; Tier 1 inspections | 2 | 3 | 3 | 18 | | | | | |
| Machining Materials | Non-rad airborne particulates | PPE; ventilation; maintenance; work planning | 2 | 1 | 2 | 4 | | | | | |
| Walking – Working Surfaces | Falls on same level | PPE; Tier 1; work planning; P.E. scheduled maintenance; internal and external audits; posting; labeling; training; barriers; communication; lessons learned; safety checklist for Walking and Working Surfaces | 5 | 4 | 2 | 40 | | | | | |
| Work At Heights | Falls to lower level, such as falling from a ladder or over a railing | Postings; barriers; fall protection; maintenance; training; work planning; procedures; Tier 1 inspections; PPE; approved scaffolding and platforms; approved ladders; anti-slip surfaces; safety checklist for Walking and Working Surfaces | 4 | 5 | 2 | 40 | | | | | |
| Working Environment | Poor air quality; mold | HVAC; facility maintenance; Tier 1 inspections | 5 | 2 | 2 | 20 | | | | | |
| Water | Being struck by an object due to a pressure release | Postings; maintenance; PPE; training; work planning; ASSRC review; procedures; Tier 1 inspections; PLC monitoring and interlocks | 4 | 1 | 3 | 12 | | | | | |
| Water | Contact with temperature – extremes that result in such injuries as heat exhaustion, frost bite or burns | Postings; maintenance; PPE; training; work planning; ASSRC review; procedures; Tier 1 inspections | 4 | 1 | 2 | 8 | | | | | |
| Tours | Internal or external radiation | Postings; trained escorts; RCD concurrence to enter radiation areas; RWP; work planning; training waiver; red TLD; BNL minors policy | 3 | 1 | 2 | 6 | | | | | |
| Transformer And Switch Yards | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; installations comply with applicable codes; procedures; training; LOTO; qualified electricians; postings; locked areas; work planning; grounding standards; emergency procedures; grounding before work start. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Transformer And Switch Yards | Arc blast | PPE; procedures; training; qualified electricians. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Standby Generators | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; disconnected cable policy; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; locked areas; guarding; work planning; grounding standards; emergency procedures, two-person rule for energized electrical work. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 2 | 4 | 2 | 16 | | | | | |
| Standby Generators | Noise | Hearing protection. | 2 | 4 | 2 | 16 | | | | | |

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| Radioactive Sources | Internal or external radiation | Training; BNL and C-AD source custodians; source inventory; shielding; locked boxes; leak checks; posting; dosimetry; Chipmunk calibration procedures; locked cage for Chipmunk source | 2 | 1 | 2 | 4 | | | | | |
| Pressurized Systems | Being struck by an object due to a pressure release | Postings; PPE; maintenance; training; work planning; ESRC reviews; procedures; interlock systems; certification/testing of pressure related equipment; Tier 1 inspections; LOTO; C-AD Chief ME reviews; codes and standards usage | 2 | 2 | 2 | 8 | | | | | |
| Noise | Hearing loss | Training; hearing protection; noise surveys; procedures; postings; medicals; engineered noise reduction; work planning; locked areas with limited access to authorized personnel only | 2 | 4 | 2 | 16 | | | | | |
| Egress | Impaired egress | Tier 1; work planning; skill of craft; P.E. scheduled maintenance; internal and external audits; posting; labeling; training; barriers; communication; internal processes; lessons learned; life safety codes; emergency preparedness | 5 | 3 | 3 | 45 | | | | | |
| Cryogenic | Being struck by an object due to a pressure release | Postings; maintenance; training; work planning; LOTO; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; interlock systems; Tier one inspection; pressure testing | 4 | 2 | 2 | 16 | | | | | |
| Cryogenic | Contact with temperature – extremes that result in such injuries as frost bite or burns | Postings; maintenance; training; work planning; LOTO; Cryogenic Safety Committee /ASSRC reviews; procedures; PPE; interlock systems; Tier 1 inspection | 4 | 3 | 2 | 24 | | | | | |
| Confined Spaces | Becoming caught in or compressed by equipment | Barriers; postings; training; Confined Spaces Permits; work planning; procedures; Tier 1 inspections | 2 | 2 | 3 | 12 | | | | | |
| Computer And Office Machine Usage | Repetitive motion | BNL SHSD ergonomic reviews; training; use of ergonomically designed equipment | 5 | 3 | 3 | 45 | | | | | |
| Batteries/UPS | Molten spray | PPE; procedures; training. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 4 | 2 | 1 | 8 | | | | | |
| Batteries/UPS | Chemical burn | PPE; procedures; training. | 3 | 2 | 2 | 12 | | | | | |
| Batteries/UPS | Shock or electrocution | All equipment is listed or reviewed by CEE; Tier 1 inspections; installations comply with applicable codes; procedures; training; distribution drawings; LOTO; Kirk keys; energized electrical work permits; ASSRC/ESRC reviews; qualified electricians and technicians; cabinet interlocks; postings; guarding; work planning; grounding standards; emergency procedures. C-AD management has implemented requirements and mechanisms to meet PPE requirements identified in NFPA 70E as of December 22, 2004. Enhanced PPE requirements established April 2006. Implementation of a plan to meet OSHA’s NRTL requirements began June 1, 2005. | 5 | 3 | 2 | 30 | | | | | |
| Limited Access Areas | Impaired egress | Tier 1; work planning; skill of craft; training; barriers; | 3 | 3 | 1 | 9 | | | | | |
| Lasers | Eye damage | Barriers; interlock systems; postings; training; LSO review; work planning; PPE; procedures; Tier 1 inspections; warning systems | 2 | 4 | 3 | 24 | | | | | |
| Confined Spaces | Oxygen deficiency | Training; atmospheric testing before entry and periodically; entry procedures; Permits; work planning; LOTO; respirators; forced ventilation; personnel rescue equipment; emergency planning | 1 | 5 | 2 | 10 | | | | | |

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| Confined Spaces - Metal | Increased chance of shock due of proximity to conducting surfaces | All equipment is listed or reviewed by CEE; work planning; grounding standards; GFCI | 1 | 3 | 2 | 6 | | | | | |
| Further Description of Controls Added to Reduce Risk: <u>Temporary Procedure to Open or Close Breakers and Switches</u> to enhance NFPA 70 E PPE requirements, enhanced awareness, PPE labels on breakers, panels or switches | | | | | | | | | | | |
| *Risk: | 0 to 20 | 21 to 40 | 41-60 | | 61 to 80 | | 81 or greater | | | | |
| | Negligible | Acceptable | Moderate | | Substantial | | Intolerable | | | | |